INDIANA DEPARTMENT of EDUCATION

2023 INDIANA ACADEMIC STANDARDS
MATHEMATICS

GRADE 6

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Indiana Academic Standards Context and Purpose

Introduction

The Indiana Academic Standards for Grade 6 Mathematics are the result of a process designed to identify, evaluate, synthesize, and create high-quality, rigorous learning expectations for Indiana students.

Pursuant to Indiana Code (IC) 20-31-3-1(c-d), the Indiana Department of Education (IDOE) facilitated the prioritization of the Indiana Academic Standards. All standards are required to be taught. Standards identified as essential for mastery by the end of the grade level are indicated with shading and an "E." The learning outcome statement for each domain immediately precedes each set of standards.

The Indiana Academic Standards are designed to ensure that all Indiana students, upon graduation, are prepared with essential knowledge and skills needed to access employment, enrollment, or enlistment leading to service.

What are the Indiana Academic Standards and how should they be used?

The Indiana Academic Standards are designed to help educators, parents, students, and community members understand the necessary content for each grade level, and within each content area domain, to access employment, enrollment, or enlistment leading to service. These standards should form the basis for strong core instruction for all students at each grade level and content area. The standards identify the minimum academic content or skills that Indiana students need in order to be prepared for success after graduation, but they are not an exhaustive list.

While the Indiana Academic Standards establish key expectations for knowledge and skills and should be used as the basis for curriculum, the standards by themselves do not constitute a curriculum. It is the responsibility of the local school corporation to select and formally adopt curricular tools, including textbooks and any other supplementary materials, that align with Indiana Academic Standards. Additionally, corporation and school leaders should consider the appropriate instructional sequence of the standards as well as the length of time needed to teach each standard. Every standard has a unique place in the continuum of learning, but each standard will not require the same amount of time and attention. A deep understanding of the vertical articulation of the standards will enable educators to make the best instructional decisions. These standards must also be complemented by robust, evidence-based instructional practices to support overall student development. By utilizing strategic and intentional instructional practices, other areas such as STEM and employability skills can be integrated with the content standards.

Content-Specific Considerations

The Indiana Academic Standards for Grade 6 Mathematics consist of five domains: Number Sense; Ratios and Proportional Reasoning; Algebra and Functions; Geometry and Measurement; and Data Analysis and Statistics.The skills listed in each domain indicate what students should know and be able to do in Mathematics at each grade level. The Process Standards demonstrate the ways in which students should develop conceptual understanding of mathematical content, and the ways in which students should synthesize and apply mathematical skills.

Acknowledgments

The Indiana Department of Education appreciates the time, dedication, and expertise offered by Indiana's K-12 educators, higher education professors, representatives from business and industry, families, and other stakeholders who contributed to the development of the Indiana Academic Standards. We wish to specially acknowledge the committee members, as well as participants in the public comment period, who dedicated many hours to the review and evaluation of these standards designed to prepare Indiana students for success after graduation.

Mathematics Process Standards

PS.1: Make sense of problems and persevere in solving them.
Mathematically proficient students start by explaining to themselves the meaning of a problem and looking for entry points to its solution. They analyze givens, constraints, relationships, and goals. They make conjectures about the form and meaning of the solution and plan a solution pathway, rather than simply jumping into a solution attempt. They consider analogous problems and try special cases and simpler forms of the original problem in order to gain insight into its solution. They monitor and evaluate their progress and change course if necessary. Mathematically proficient students check their answers to problems using a different method, and they continually ask themselves, "Does this make sense?" and "Is my answer reasonable?" They understand the approaches of others to solving complex problems and identify correspondences between different approaches. Mathematically proficient students understand how mathematical ideas interconnect and build on one another to produce a coherent whole.

PS.2: Reason abstractly and quantitatively.
Mathematically proficient students make sense of quantities and their relationships in problem situations. They bring two complementary abilities to bear on problems involving quantitative relationships: the ability to decontextualize—to abstract a given situation and represent it symbolically and manipulate the representing symbols as if they have a life of their own, without necessarily attending to their referents—and the ability to contextualize, to pause as needed during the manipulation process in order to probe into the referents for the symbols involved. Quantitative reasoning entails habits of creating a coherent representation of the problem at hand; considering the units involved; attending to the meaning of quantities, not just how to compute them; and knowing and flexibly using different properties of operations and objects.

PS.3: Construct viable arguments and critique the reasoning of others.
Mathematically proficient students understand and use stated assumptions, definitions, and previously established results in constructing arguments. They make conjectures and build a logical progression of statements to explore the truth of their conjectures. They analyze situations by breaking them into cases and recognize and use counterexamples. They organize their mathematical thinking, justify their conclusions and communicate them to others, and respond to the arguments of others. They reason inductively about data, making plausible arguments that take into account the context from which the data arose. Mathematically proficient students are also able to compare the effectiveness of two plausible arguments, distinguish correct logic or reasoning from that which is flawed, and—if there is a flaw in an argument—explain what it is. They justify whether a given statement is always true, sometimes, or never. Mathematically proficient students participate and collaborate in a mathematics community. They listen to or read the arguments of others, decide whether they make sense, and ask useful questions to clarify or improve the arguments.

PS.4: Model with mathematics.
Mathematically proficient students apply the mathematics they know to solve problems arising in everyday life, society, and the workplace using a variety of appropriate strategies. They create and use a variety of representations to solve problems and to organize and communicate mathematical ideas. Mathematically proficient students apply what they know and are comfortable making assumptions and approximations to simplify a complicated situation, realizing that these may need revision later. They are able to identify important quantities in a practical situation and map their relationships using such tools as diagrams, two-way tables, graphs, flowcharts, and formulas. They analyze those relationships mathematically to draw conclusions. They routinely interpret their mathematical results in the context of the situation and reflect on whether the results make sense, possibly improving the model if it has not served its purpose.

PS.5: Use appropriate tools strategically.

Mathematically proficient students consider the available tools when solving a mathematical problem. These tools might include pencil and paper, models, a ruler, a protractor, a calculator, a spreadsheet, a computer algebra system, a statistical package, or dynamic geometry software. Mathematically proficient students are sufficiently familiar with tools appropriate for their grade or course to make sound decisions about when each of these tools might be helpful, recognizing both the insight to be gained and their limitations. Mathematically proficient students identify relevant external mathematical resources, such as digital content, and use them to pose or solve problems. They use technological tools to explore and deepen their understanding of concepts and to support the development of learning mathematics. They use technology to contribute to concept development, simulation, representation, reasoning, communication, and problem solving.

PS.6: Attend to precision.

Mathematically proficient students communicate precisely to others. They use clear definitions, including correct mathematical language, in discussion with others and in their own reasoning. They state the meaning of the symbols they choose, including using the equal sign consistently and appropriately. They express solutions clearly and logically by using the appropriate mathematical terms and notation. They specify units of measure and label axes to clarify the correspondence with quantities in a problem. They calculate accurately and efficiently and check the validity of their results in the context of the problem. They express numerical answers with a degree of precision appropriate for the problem context.

PS.7: Look for and make use of structure.

Mathematically proficient students look closely to discern a pattern or structure. They step back for an overview and shift perspective. They recognize and use properties of operations and equality. They organize and classify geometric shapes based on their attributes. They see expressions, equations, and geometric figures as single objects or as being composed of several objects.

PS.8: Look for and express regularity in repeated reasoning.

Mathematically proficient students notice if calculations are repeated and look for general methods and shortcuts. They notice regularity in mathematical problems and their work to create a rule or formula. Mathematically proficient students maintain oversight of the process, while attending to the details as they solve a problem. They continually evaluate the reasonableness of their intermediate results.

Grade 6 Mathematics

Standards identified as essential for mastery by the end of the grade level are indicated with gray shading and an "E." The learning outcome statement for each domain immediately precedes each set of standards.

Number Sense	
Learning Outcome: Students begin to apply negative integers within real-world contexts and use number lines to model opposite signed numbers as located on opposite sides of zero.	
6.NS.1	Use positive and negative numbers to represent and compare quantities in real-world contexts, explaining the meaning of 0 in each situation. (E)
6.NS.2	Explain how opposite signs of numbers indicate locations on opposite sides of 0 on the number line; identify the opposite of the opposite of a number.
6.NS.3	Compare and order rational numbers and plot them on a number line. Write, interpret, and explain statements of order for rational numbers in real-world contexts.
6.NS.4	Solve real-world problems with positive fractions and decimals by using one or two operations. (E)
6.NS.5	Apply the order of operations and properties of operations (i.e., identity, inverse, commutative properties of addition and multiplication, associative properties of addition and multiplication, and distributive property) to evaluate numerical expressions with nonnegative rational numbers, including those using grouping symbols, such as parentheses, and involving whole number exponents. (E)
6.NS.6	Find the greatest common factor of two whole numbers less than or equal to 100 and the least common multiple of two whole numbers less than or equal to 12. Use the distributive property to express a sum of two whole numbers from 1 to 100, with a common factor as a multiple of a sum of two whole numbers with no common factor.
6.NS.7	Apply the properties of operations (i.e., identity, inverse, commutative, associative, distributive properties) to create equivalent linear expressions and to justify whether two linear expressions are equivalent when the two expressions name the same number regardless of which value is substituted into them. (E)
6.NS.8	Evaluate positive rational numbers with whole number exponents.
Ratios and Proportional Reasoning	
Learning Outcome: Students use ratios and reasoning to compare two quantities and understand unit rate. Students use ratios and unit rates to model and solve real-world problems.	
6.RP.1	Convert between any two representations (fractions, decimals, percents) of positive rational numbers without the use of a calculator. (E)
6.RP.2	Understand the concept of a unit rate and use terms related to rate in the context of a ratio relationship.
6.RP.3	Make tables of equivalent ratios relating quantities with whole-number measurements, find missing values in the tables, and plot the pairs of values on the coordinate plane.

6.RP.4	Solve real-world and other mathematical problems involving rates and ratios using models and strategies such as reasoning about tables of equivalent ratios, tape diagrams, double number line diagrams, or equations. (E)
6.RP.5	Use variables to represent two quantities in a proportional relationship in a real-world problem; write an equation to express one quantity, the dependent variable, in terms of the other quantity, the independent variable. Analyze the relationship between the dependent and independent variables using graphs and tables, and relate these to the equation. (E)

Algebra and Functions

Learning Outcome: Students evaluate algebraic expressions, write algebraic expressions to represent quantities in context, and create equivalent algebraic expressions.

6.AF.1	Define and use multiple variables when writing expressions to represent real-world and other mathematical problems, and evaluate them for given values. (E)
6.AF.2	Demonstrate which values from a specified set, if any, make the equation or inequality true. Use substitution to determine whether a given number in a specified set makes an equation or inequality true. (E)
6.AF.3	Solve equations of the form $x + p = q$, $x - p = q$, $px = q$, and $x/p = q$ fluently for cases in which p, q and x are all nonnegative rational numbers. Represent real-world problems using equations of these forms and solve such problems. (E)
6.AF.4	Write an inequality of the form $x > c$, $x \geq c$, $x < c$, or $x \leq c$, where c is a rational number, to represent a constraint or condition in a real-world or other mathematical problem. Explain that inequalities have infinitely many solutions and how to represent solutions on a number line diagram.
6.AF.5	Solve real-world and other mathematical problems by graphing points with rational number coordinates on a coordinate plane. Include the use of coordinates and absolute value to find distances between points with the same first coordinate or the same second coordinate. (E)

Geometry and Measurement

Learning Outcome: Students find areas of complex shapes and find volumes of rectangular prisms.

6.GM.1	Convert between measurement systems (Customary to metric and metric to Customary) given the conversion factors, and use these conversions in solving real-world problems.
6.GM.2	Apply the sums of interior angles of triangles and quadrilaterals to solve real-world and mathematical problems.
6.GM.3	Find the area of complex shapes composed of polygons by composing or decomposing into simple shapes; apply this technique to solve real-world and other mathematical problems.
6.GM.4	Find the volume of a right rectangular prism with fractional edge lengths using unit cubes of the appropriate unit fraction edge lengths (e.g., using technology or concrete materials) and show that the volume is the same as would be found by multiplying the edge lengths of the prism. Apply the formulas $V = lwh$ and $V = Bh$ to find volumes of right rectangular prisms with fractional edge lengths to solve real-world and other mathematical problems. (E)

	Data Analysis and Statistics
Learning Outcome: Students represent data using line plots, histograms, and box plots.	
6.DS.1	Select, create, and interpret graphical representations of numerical data, including line plots, histograms, and box plots.
6.DS.2	Formulate statistical questions; collect and organize the data (e.g., using technology), and display and interpret the data with graphical representations (e.g., using technology). (E)
6.DS.3	Summarize numerical data sets in relation to their context in multiple ways, such as: a. Report the number of observations; b. Describe the nature of the attribute under investigation, including how it was measured and its units of measurement; c. Determine quantitative measures of center (mean and/or median) and spread (range and interquartile range); d. Describe any overall pattern and any striking deviations from the overall pattern with reference to the context in which the data were gathered; and e. Relate the choice of measures of center and spread to the shape of the data distribution and the context in which the data were gathered. (E)